

## New Records of Two Genera *Leptoseris* and *Phyllangia* (Anthozoa: Hexacorallia: Scleractinia) from Korea

Eunae Choi, Jun-Im Song\*

College of Natural Sciences, Ewha Womans University, Seoul 120-750, Korea

### ABSTRACT

Two scleractinian species are newly recorded in Korea: *Leptoseris mycetoseroides* Wells, 1954 and *Phyllangia hayamaensis* (Eguchi, 1968). The two genera *Leptoseris* Milne Edwards and Haime, 1849 and *Phyllangia* Milne Edwards and Haime, 1848 are also newly recorded in Korea. The specimens were collected from the subtidal zones of Jeju-do Island, Korea by SCUBA diving from 1991 to 2007. *Leptoseris mycetoseroides* is characterized by its platelike growth form, intratentacular budding, irregularly developed collines, single styliform columella, and even septa and septocostae. *Phyllangia hayamaensis* is distinguished by its encrusting and plocoid growth form of corallites basally united with common coenosteum, trabecular columella, and irregular septal arrangements and paliform lobes.

**Keywords:** Anthozoa, Scleractinia, Agariciidae, Caryophylliidae, *Leptoseris*, *Phyllangia*, Korea

### INTRODUCTION

The family Agariciidae Gray, 1847 includes seven genera and 47 species (Kitahara et al., 2012), 18 species of which belong to the genus *Leptoseris* Milne Edwards and Haime, 1849 (World Register of Marine Species, 2015a). The family Caryophylliidae Dana, 1846 comprises 43 genera and 294 species (Roberts et al., 2009), eight species of which belong to the genus *Phyllangia* Milne Edwards and Haime, 1848 (Roberts et al., 2009; World Register of Marine Species, 2015b).

On the other hand, no species of the family Agariciidae and six species of the family Caryophylliidae have been recorded in Korea (Song, 1982, 1988, 1991, 2004; Song and Lee, 1998): *Caryophyllia* (C.) *japonica* Marenzeller, 1888, *Crispatotrochus niinoi* (Yabe and Eguchi, 1942), *Heterocyathus aequicostatus* Milne Edwards and Haime, 1848, *Heterocyathus japonicus* (Verrill, 1866), *Stephanocyathus* (A.) *spiniger* (Marenzeller, 1888), and *Goniocorella dumosa* (Alcock, 1902).

This study describes two new records of scleractinian species from Korea: *Leptoseris mycetoseroides* of the family Agariciidae and *Phyllangia hayamaensis* of the family Caryophylliidae.

### MATERIALS AND METHODS

The specimens were collected from the subtidal zones off Mara-do, Chagwi-do, and Seopseom in Jeju-do Island, Korea by SCUBA diving from 1991 to 2007. The specimens were dissolved in sodium hypochlorite solution with distilled water for 24 hours to remove all soft parts, washed in distilled water, and dried to examine the skeletal structures. The growth forms and shapes of coralla were photographed with digital cameras (G12; Canon Inc., Tokyo, Japan and Optio WG2; Pentax Ricoh Imaging Co. Ltd., Tokyo, Japan). The skeletal structures of corallites were observed with a stereomicroscope (Leica S8APO; Leica Microsystems, Wetzlar, Germany), photographed with a mounted camera (Leica Microsystems), and measured with an image analyzer (LAS Ver. 3.6; Leica Microsystems). Multi-focused images were taken in series and combined with an image editing program (HeliconFocus 5.3 Pro; Helicon Soft Ltd., Kharkov, Ukraine) to provide clear images of the detailed skeletal structures. The classification of scleractinians in the present study partly followed Wells (1956), Veron (2000), and Roberts et al. (2009). The morphological terms were referenced from Wells (1956), Dinesen (1980), and Cairns and Kitahara (2012). The specimens examined in this study are deposited at the

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**\*To whom correspondence should be addressed**  
Tel: 82-2-3277-2364, Fax: 82-2-3277-2385  
E-mail: jisong@ewha.ac.kr

Ewha Womans University Natural History Museum, Korea.

## SYSTEMATIC ACCOUNTS

Phylum Cnidaria Hatschek, 1888  
Class Anthozoa Ehrenberg, 1834  
Subclass Hexacorallia Haeckel, 1866  
Order Scleractinia Bourne, 1900  
Family Agariciidae Gray, 1847

**Diagnosis.** Corallum solitary or colonial, attached. Growth form encrusting, massive, columnar, foliose, branching mainly by intratentacular budding. Septa rarely porous. Septal faces covered by granules. Columella present or absent.

<sup>1</sup>\*Genus *Leptoseris* Milne Edwards and Haime, 1849

**Diagnosis.** Corallum solitary or colonial, attached. Growth form encrusting, massive, columnar, foliose, branching mainly by intratentacular budding. Collines present or absent. Proximal cushions or hydraphoroid projections present or absent. Central corallite present or absent. Septa and septocostae even or alternating. Columella present or absent.

<sup>2</sup>\**Leptoseris mycetoseroides* Wells, 1954 (Fig. 1)

*Agaricia minikoiensis*: Yabe et al., 1936: 55, Pl. 42, figs. 5–7.

*Leptoseris mycetoseroides* Wells, 1954: 445, Pl. 153, figs. 4–6; Veron and Pichon, 1979: 57, figs. 99–102; Dinesen, 1980: 197, Pl. 11–13; Veron, 1986: 305; 1992: 117; 2000: Vol. 2, 213; Nishihira and Veron, 1995: 224; Dai and Horng, 2009: 140.

**Material examined.** Korea: Jeju-do: 1 ind., Seogwipo-si, Seopseom, 10 Sep 2007, Hwang SJ, Cho IY, 10 m deep by SCUBA diving (EWZS 1022).

**Description.** Corallum colonial, attached. Growth form platelike or explanate by intratentacular budding from corallite margins. Corallum part of thin plate, unifacial, 35–60 mm in width, 1–3 mm in thickness. Upper surface striated distinctively, thinner towards margins of corallum. Under surface glossy, smooth, striated indistinctively at inner parts of corallum, but striated distinctively at margins of corallum. Corallites sunken, concave, irregularly scattered or in series of 2–7 centers (average 3.4 centers) per row enclosed by collines, inclined towards margins of corallum. 2–6 corallites (average 4 corallites) in 5 × 5 mm, but corallites rarer at margins of corallum. Central or parent corallite absent or indistinguishable.

Collines enclosing corallites irregularly, but well developed. Distance between collines 1.47–6.29 mm (average 3.40 mm). Intercorallite distance within series 0.60–3.01 mm (average 1.54 mm). Intercorallite distance between series 2.16–5.23 mm (average 3.23 mm). Calice elliptical or circular or slightly polygonal or irregular, 1.57–3.10 × 1.94–4.46 mm (average 2.46 × 3.09 mm) in diameter. Fossa elliptical or circular, 0.18–0.26 × 0.25–0.70 mm (average 0.23 × 0.38 mm) in diameter, approximately 0.4 mm or shallow in depth. Columella single styliform, 0.06–0.12 × 0.09–0.47 mm (average 0.09 × 0.19 mm) in diameter. Corallite wall not developed. Exsertness and thickness of septa and septocostae vary. Septa thin, even or subequal or moderately unequal, imperforate, spiny, straight in general, contorted, thickened near outer calicular margins. 16–30 septa (average 19.8–23.3 septa) per corallite. 5–14 septa (average 10.5 septa) reaching columella. Septal upper margins rounded. Septocostae 3–7 (average 5.5) in 1 mm, 0.08–0.22 mm (average 0.14 mm) in thickness (including thickness of septal lateral spines) at inner parts of corallum, 5–6 (average 5.8) in 1 mm, 0.08–0.15 mm (average 0.10 mm) in thickness at margins of corallum. Space between septocostae 0.03–0.07 mm (average 0.05 mm) in thickness at inner parts of corallum, 0.09–0.15 mm (average 0.12 mm) in thickness at margins of corallum.

**Color.** Coenosarc brown.

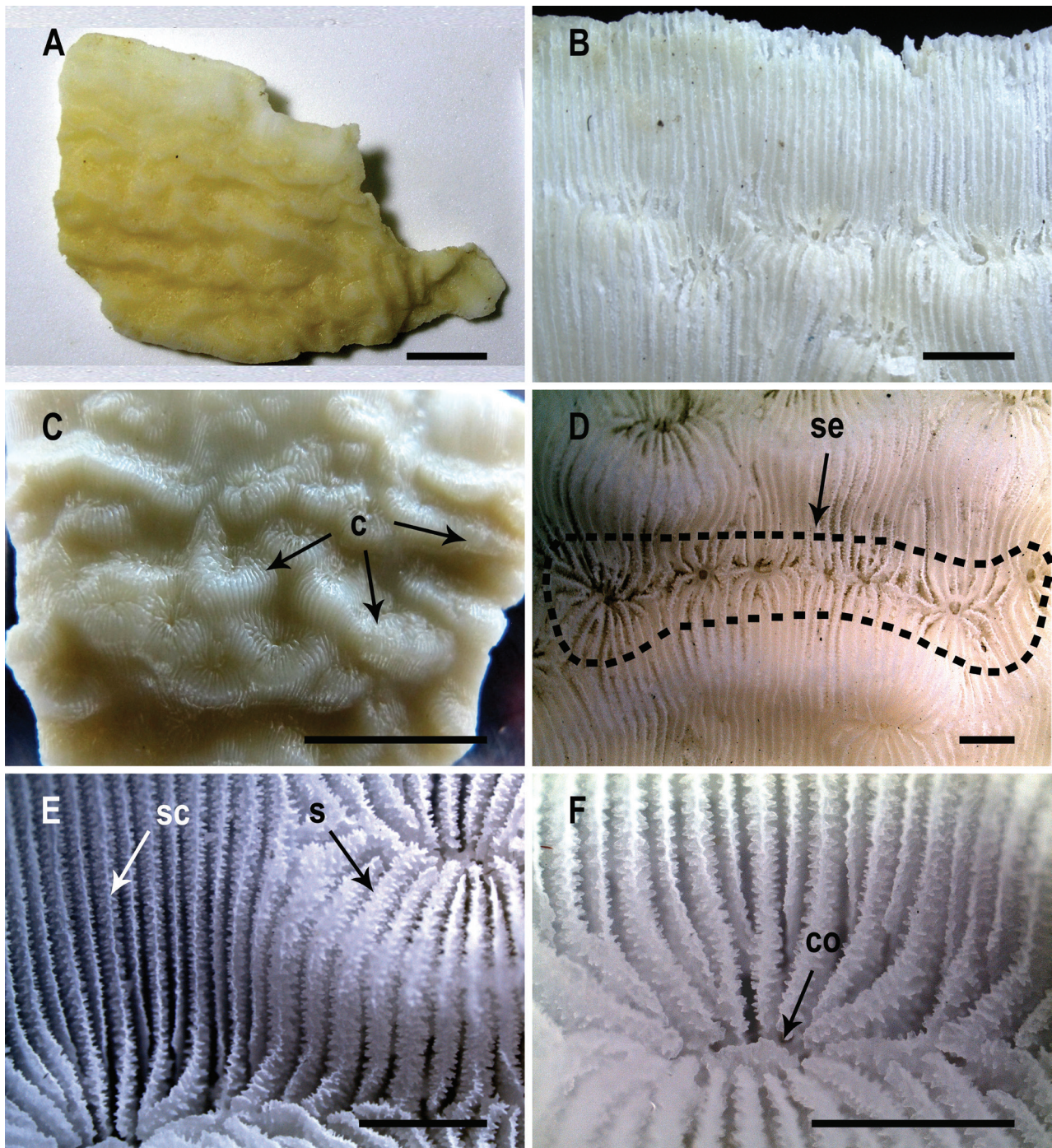
**Habitat.** This species inhabits subtidal zones of 10 m in depth. Tube worms, and hydroids live in ectosymbiosis on the corallum.

**Remarks.** *Leptoseris mycetoseroides* Wells, 1954 is known as the most variable species within the genus, due to variations in corallite size, septal number, and the development of collines (Wells, 1954; Dinesen, 1980). The specimen examined in this study is similar to those in previous studies, with irregularly developed collines, sunken or concave corallites, and even septa and septocostae (Table 1). *L. mycetoseroides* differs from *L. hawaiiensis* Vaughan, 1907 by its well-developed collines, absent or indistinguishable central corallite, and numerous septocostae in 5 mm, and from *L. foliosa* Dinesen, 1980 by its explanate growth form with large corallites (Veron and Pichon, 1979; Dinesen, 1980; Veron, 1986, 2000; Nishihira and Veron, 1995; Benzoni et al., 2012).

**Distribution.** Pacific Ocean: Korea (Jeju-do Island), Japan (Southern Honshu, Southern Shikoku, Southern Kyushu, Okinawa), Taiwan, Philippines, Indonesia, Celebes, Australia (Great Barrier Reef), Houtman Abrolhos Island, Solomon Islands, Marshall Islands; Indian Ocean: Madagascar, Reunion, Mauritius, Saya de Malha, Chagos Archipelago.

Korean name: <sup>1</sup>\*판열돌산호속 (신칭), <sup>2</sup>\*버섯판열돌산호 (신칭)





**Fig. 1.** *Leptoseris mycetoseroides*. A, Growth form, platelike; B, Margins of corallum; C, Collines (c); D, Series of corallites by intratentacular budding (se); E, Septocostae (sc) and septa (s); F, Columella (co), single styliform. Scale bars: A, C=1 cm, B, D-F=1 mm.

Family Caryophylliidae Dana, 1846

**Diagnosis.** Corallum solitary or colonial, free or attached. Colony formed mainly by extratentacular budding. Theca

well developed. Septa exsert. Septa laminar with smooth inner edges. Septal arrangement usually hexamorous. Pali or paliiform lobes present or absent. Columella present or absent.

**Table 1.** Comparison of *Leptoseris mycetoseroides* morphological characters with two similar species

Morphological character	<i>L. mycetoseroides</i>		<i>L. hawaiiensis</i>	<i>L. foliosa</i>
	This study	Wells (1954), Dinesen (1980), Veron (2000)	Dinesen (1980)	Dinesen (1980), Benzoni et al. (2012)
Growth form	Thin, platelike	Thin, explanate; encrusting	Encrusting	Encrusting base, with foliose or fan-shaped upper parts
Calicular diameter: LCD×GCD (mm)	1.57–3.10×1.94–4.46 (average 2.46×3.09)	1.0–4.0×1.0–7.0 (mean 1.0–3.0×1.0–5.0)	1.0–5.0×1.0–7.0 (mean 2.0–4.0×2.0–5.0)	1.0–2.0×1.0–4.0 (mean 1.0–1.5×1.0–2.0)
Central corallite	Absent or indistinguishable	Rarely distinguishable	Sometimes distinguishable	Rarely distinguishable
Collines	Well developed, irregular	Well developed, highly variable	Absent or very poorly developed	Absent (smooth) or present (ridged)
Septa/septocostae	Even or subequal or moderately unequal	Equal or subequal; even	Equal or subequal with pointed upper margins	Equal, close; unequal/ equal
No. of septa/no. of septa reaching columella	16–30 (average 19.8– 23.3)/5–14 (average 10.5)	25–35/12–16; 6–32 (mean 17)/most or sometimes half septa reach columella	8–48 (mean 21)/septa reaching columella vary	8–28 (mean 18)/most septa reach columella
No. of septocostae in 5 mm	15–35 (average 27.3)	20–30; 14–32 (mean 24)	15–26 (mean 19)	18–28 (mean 21)

LCD, lesser calicular diameter; GCD, greater calicular diameter.

<sup>1</sup>\*Genus *Phyllangia* Milne Edwards and Haime, 1848

**Diagnosis.** Corallum colonial, attached. Growth form encrusting or reptoid. Septa hexamerously arranged in multiple cycles. Septal inner edges smooth. Columella present. Pali or paliform lobes present.

<sup>2</sup>\**Phyllangia hayamaensis* (Eguchi, 1968) (Fig. 2)

*Astrangia hayamaensis* Eguchi, 1968: C26, Pl. C27, figs. 8–10, Pl. C28, fig. 7.

*Phyllangia hayamaensis*: Cairns, 1994: 62; Ogawa et al., 1996: 41, Pl. 2, fig. 1, Pl. 4, fig. 4; 1997: 51, fig. 4.

**Material examined.** Korea: Jeju-do: 1 ind., Seogwipo-si, Mara-do, 25 Oct 1991, Song JI, Won JH (EWZS 4123); 1 ind., Jeju-si, Chagwi-do, 6 Nov 2000, Song JI, 20–25 m deep (EWZS 4114).

**Description.** Corallum colonial, attached. Growth form encrusting mainly by extratentacular budding forming plocoid or reptoid colony of corallites, united basally with thick common coenosteum. Intratentacular budding observed. Corallum 45–60 mm in width, 4–40 mm in height. 13–17 corallites (average 14.8) in 30×30 mm. Intercorallite distance 4–14 mm (average 8.56 mm). Corallite cylindrical, 2.0–7.0×2.5–11.0 mm (average 5.68×6.59 mm) in calicular diameter,

1–12 mm (average 4.55 mm) in height from common coenosteum. Calice elliptical or circular. Fossa 2–4 mm (average 3.45 mm) in depth. Columella trabecular or fusions of septal inner edges or spongy, 0.85–2.01×1.03–2.85 mm (average 1.47×1.77 mm) in diameter. Theca thick, minutely granulated. Costae weakly present at upper outer thecal margins. Coenosteum non-costate, well developed. Septa irregularly, but hexamerously arranged in general from 19 to 44 in 3–4 cycles (average 34.2 in 4 incomplete cycles). Up to 56 (23+33) septa developed in enlarged corallite of intratentacular budding. All septal upper margins exert above thecal wall. Inner edges of S1, S2 entire, vertical, smooth, those of S3 dentate. S1>S2>S3>>S4 or S1>S3>S2>>S4. Pairs of S3 curved towards, united before common S2. S4 rudimentary. All septa except S4 fused with columella. Paliform lobes irregularly shaped and arranged before S3. Septal lateral faces minutely granulated.

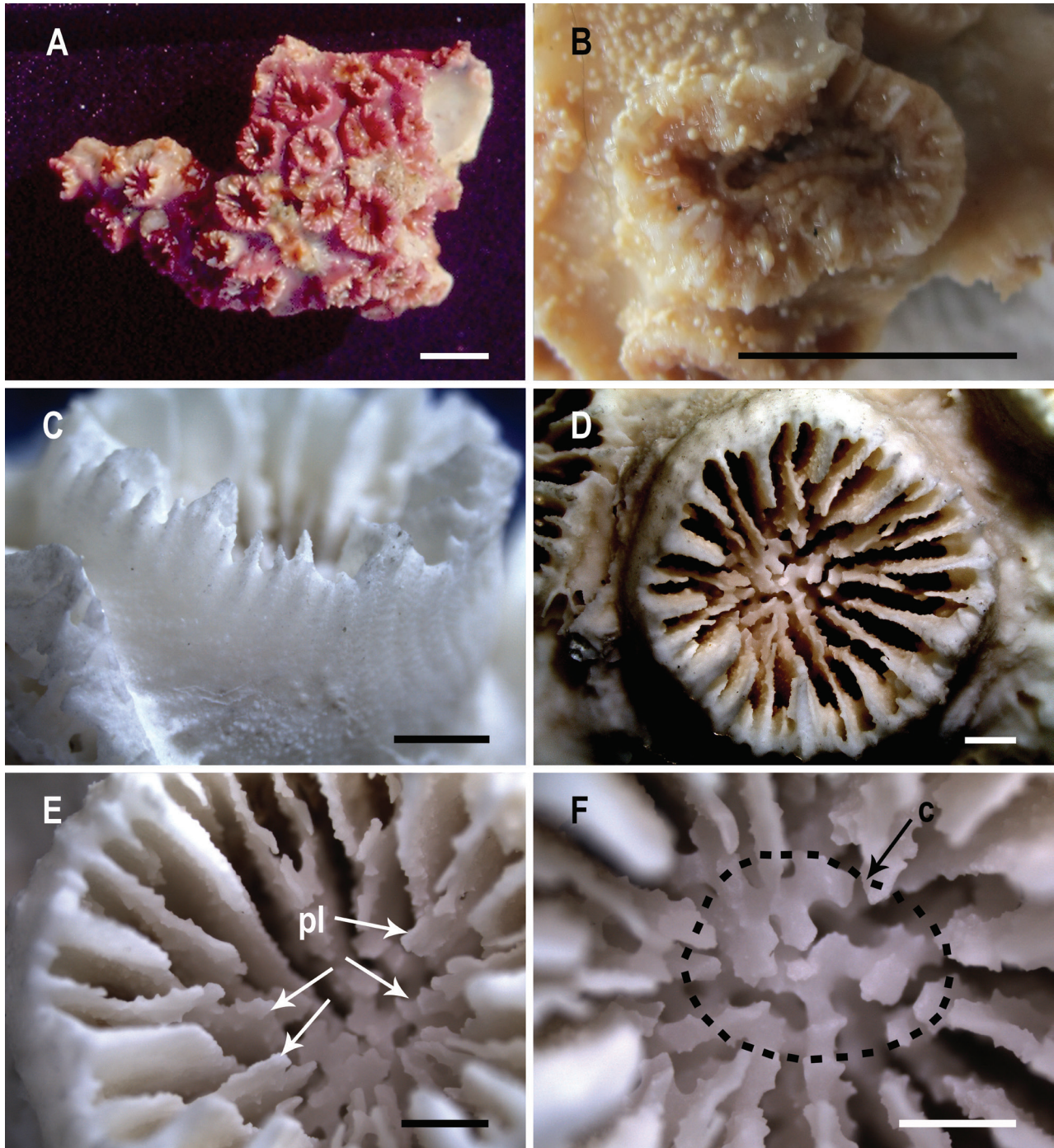
**Color.** Coenosarc pink.

**Habitat.** This species inhabits subtidal zones of 20–25 m in depth. Bryozoans, tube worms, hydroids, oysters, sponges and barnacles live in ectosymbiosis on the corallum.

**Remarks.** In the original paper (Eguchi, 1968), this species was named as *Astrangia hayamaensis*, and was characterized by the octamerous three incomplete cycles. However, the genus was changed from *Astrangia* to *Phyllangia* (Cairns,

Korean name: <sup>1</sup>\*찾잔돌산호속 (신칭), <sup>2</sup>\*찾잔돌산호 (신칭)





**Fig. 2.** *Phyllangia hayamaensis*. A, Growth form, encrusting plocoid; B, Intratentacular budding; C, Theca, exsert, granulated, weakly costate; D, Septa, hexamerously arranged in 4 incomplete cycles; E, Paliform lobes (pl), irregularly arranged; F, Columella (c), trabecular. Scale bars: A, B=1 cm, C-F=1 mm.

1994; Ogawa et al., 1996) based on the presence of paliform lobes and the smooth septal inner edges (Cairns, 1994; Ogawa et al., 1996; Cairns and Kitahara, 2012). Furthermore, it was corrected and redescribed that the septal arrangement of the

species is irregular, but basically hexamerous in four incomplete cycles (Ogawa et al., 1996). The specimen from Marado is distinguished by its greater number of septa (average 39.4) than those described in previous records from Japan

**Table 2.** Comparison of *Phyllangia hayamaensis* and *P. echinosepes* morphological characters

Morphological character	<i>P. hayamaensis</i>		<i>P. echinosepes</i>	
	This study		Eguchi (1968), Ogawa et al. (1996)	Ogawa et al. (1997)
	EWZS 4123	EWZS 4114		
Calicular diameter: LCD×GCD (mm)	2.0–7.0×2.5–11.0 (average 5.68×6.59) 2.0–7.0×3.0–11.0 (average 5.78×6.83)	2.5–7.0×2.5–7.1 (average 5.58×6.35)	3×4–6×7; (average 5.5×6.2)	4.7–5.4×5.2–5.9 (mean 5.1×5.6)
Height from coenosteum (mm)	1–12 (average 4.55) 1–6 (average 3.47)	1–12 (average 5.70)	Up to 7; (average 4.1)	3–5
Depth of fossa (mm)	2–4 (average 3.45) 2–4 (average 2.90)	2–4 (average 4.00)	4–6; (average 2.6)	1–2 (mean 1.6)
No. of septa	19–44 (average 34.2), up to 56 19–44 (average 39.4), up to 56	22–32 (average 29.0)	20–25; 24–32 (average 29)	31–44 (mean 39)
Remarks	Extra-, intra-tentacular budding	–	–	Septa covered by spinuous beads

LCD, lesser calicular diameter; GCD, greater calicular diameter.

(Eguchi, 1968; Ogawa et al., 1996, 1997), in addition to the intratentacular budding of an enlarged corallite with a calicular diameter of  $7 \times 11$  mm and 56 septa (Table 2). *Phyllangia hayamaensis* (Eguchi, 1968) is similar to *P. echinosepes* Ogawa, Takahashi and Sakai, 1997 in the encrusting growth form of cylindrical corallites basally united with common coenosteum, and the hexamerous arrangement in four incomplete cycles. However, the latter species differs from the former species by its small calicular diameter, numerous septa, and distinctive spinous ornamentations of the septal lateral faces (Ogawa et al., 1997).

**Distribution.** Pacific Ocean: Korea (Jeju-do Island), Japan (Southern Honshu).

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## REFERENCES

- Benzoni F, Arrigoni R, Stefani F, Stolarski J, 2012. Systematics of the coral genus *Craterastrea* (Cnidaria, Anthozoa, Scleractinia) and description of a new family through combined morphological and molecular analyses. *Systematics and Biodiversity*, 10:417–433. <http://dx.doi.org/10.1080/1477200.2012.744369>
- Cairns SD, 1994. Scleractinia of the temperate North Pacific. *Smithsonian Contributions to Zoology*, 557:1–150.
- Cairns SD, Kitahara MV, 2012. An illustrated key to the genera and subgenera of the Recent azooxanthellate Scleractinia (Cnidaria: Anthozoa), with an attached glossary. *ZooKeys*, 227:1–47. <http://dx.doi.org/10.3897/zookeys.227.3612>
- Dai CF, Horng S, 2009. Scleractinia fauna of Taiwan. I. The complex group. National Taiwan University, Taipei, pp. 1–172.
- Dinesen ZD, 1980. A revision of the coral genus *Leptoseris* (Scleractinia: Fungina: Agariciidae). *Memoirs of the Queensland Museum*, 20:182–235.
- Eguchi M, 1968. The hydrocorals and scleractinian corals of Sagami Bay. Maruzen Co., Tokyo, pp. C1–C80.
- Kitahara MV, Stolarski J, Cairns SD, Benzoni F, Stake JL, Miller DJ, 2012. The first modern solitary Agariciidae (Anthozoa, Scleractinia) revealed by molecular and microstructural analysis. *Invertebrate Systematics*, 26:303–315. <http://dx.doi.org/10.1071/IS11053>
- Nishihira M, Veron JEN, 1995. Hermatypic corals of Japan. Kaiyusha Publishers, Tokyo, pp. 1–439 (in Japanese).
- Ogawa K, Takahashi K, Sakai K, 1997. Notes on Japanese ahermatypic corals. I. New species and subspecies of *Culicia* and *Phyllangia*. *Publications of the Seto Marine Biological Laboratory*, 38:45–52.
- Ogawa K, Takahashi K, Tachikawa H, Chiba J, 1996. A revision of Japanese ahermatypic corals around the coastal region with guide to identification. III. Genera *Rhizotrochus*, *Javania*, *Desmophyllum*, *Culicia*, *Phyllangia*, and *Oulania*. *Nankiseibutu* (The Nanki Biological Society), 38:37–48 (in Japanese).
- Roberts JM, Wheeler A, Freiwald A, Cairns SD, 2009. Cold-water corals: the biology and geology of deep-sea coral habitats. Cambridge University Press, Cambridge, pp. 1–352.
- Song JI, 1982. A study on the classification of the Korean Anthozoa. 7. Scleractinia (Hexacorallia). *Korean Journal of*

- Zoology, 25:131-148.
- Song JI, 1988. A systematic study on the Korean Anthozoa. 11. Cnidae of Scleractinia. Korean Journal of Systematic Zoology, Special Issue No. 2:25-36.
- Song JI, 1991. A systematic study on the Korean Anthozoa. 12. Order Scleractinia. Korean Journal of Systematic Zoology, 7:127-150.
- Song JI, 2004. Illustrated encyclopedia of fauna and flora of Korea. Vol. 39. Anthozoa. Ministry of Education and Human Resources, Seoul, pp. 1-643 (in Korean).
- Song JI, Lee IS, 1998. Fauna of anthozoans from adjacent waters of Geojedo Island in Korea. Korean Journal of Systematic Zoology, 14:229-242.
- Veron JEN, 1986. Corals of Australia and the Indo-Pacific. Angus and Robertson Publishers, London, pp. 1-644.
- Veron JEN, 1992. Hermatypic corals of Japan. Australian Institute of Marine Science Monograph Series, 9:1-234.
- Veron JEN, 2000. Corals of the world. Vol. 1-3. Australian Institute of Marine Science, Townsville, Vol. 1, pp. 1-463, Vol. 2, pp. 1-429, Vol. 3, pp. 1-490.
- Veron JEN, Pichon M, 1979. Scleractinia of Eastern Australia III. Families Agariciidae, Siderastreidae, Fungiidae, Oculinidae, Merulinidae, Mussidae, Pectiniidae, Caryophylliidae, Dendrophylliidae. Australian Institute of Marine Science Monograph Series, 4:1-459.
- Wells JW, 1954. Recent corals of the Marshall Islands. U.S. Geological Survey Professional Papers, 260-I:385-486.
- Wells JW, 1956. Scleractinia. In: Treatise on invertebrate paleontology. Part F: Coelenterata (Ed., Moore RC). Geological Society of America, Lawrence, KS, pp. F328-F444.
- World Register of Marine Species, 2015a. *Leptoseris* Milne Edwards and Haime, 1849 [Internet]. World Register of Marine Species (WoRMS), Accessed 4 May 2015, <<http://www.marinespecies.org/aphia.php?p=taxdetails&id=206048>>.
- World Register of Marine Species, 2015b. *Phyllangia* Milne Edwards and Haime, 1848 [Internet]. World Register of Marine Species (WoRMS), Accessed 4 May 2015, <<http://www.marinespecies.org/aphia.php?p=taxdetails&id=135097>>.
- Yabe H, Sugiyama T, Eguchi M, 1936. Recent reef-building corals from Japan and the South Sea Islands under the Japanese mandate. I. Science Reports of the Tôhoku Imperial University, Second Series (Geology), Special Volume, 1:1-66.

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